

CLAIMS

What is claimed is:

1. A method of generating a frame quantization parameter for encoding a current frame of an incoming video stream having a plurality of frames, the method comprising:
 - calculating a complexity ratio;
 - calculating a current frame bit rate using the complexity ratio factor;
 - calculating the frame quantization parameter based on the current frame bit rate.
2. The method of Claim 1, wherein the calculating a complexity ratio comprises:
 - calculating a local complexity;
 - calculating a global complexity; and
 - setting the complexity ratio to equal the local complexity divided by the global complexity.
3. The method of Claim 2, wherein the calculating a local complexity comprises:
 - calculating a new average local complexity;
 - calculating a new value for the local complexity as a weighted average of a current value of the local complexity and the new average local complexity.
4. The method of Claim 3, wherein the new average local complexity is equal to a weighted average of a plurality of frame complexities weighted by a plurality of frame types.

5. The method of Claim 2, wherein the global complexity is a long term average of the local complexity.

6. The method of Claim 2, wherein a new value for global complexity GLOBAL_CX is equal to a global complexity coefficient times the local complexity plus a current value of the global complexity times one minus the global complexity coefficient.

7. The method of Claim 1, further comprising calculating a bit balance adjustment factor that is used in the calculating a current frame bit rate using the complexity ratio factor.

8. The method of Claim 7, wherein calculating a bit balance adjustment factor comprises:

tracking a bit balance of a plurality of previously processed frames;

dividing the bit balance by a duration to generate the bit balance adjustment factor.

9. The method of Claim 7, wherein the current frame bit rate is equal to the bit balance adjustment value plus a rate control parameter multiplied by the complexity ratio C_RATIO multiplied by a frame target rate plus the frame target rate multiplied by the difference between one and the rate control parameter

10. The method of Claim 1, further comprising calculating a frame coding efficiency factor.

11. The method of Claim 10, wherein the frame coding efficiency factor is equal to a frame quality constant divided by a frame complexity.

12. The method of Claim 10, wherein a new value for the frame coding efficiency factor is equal to one minus a coding efficient coefficient CEC times the current value of frame coding efficiency factor plus the coding efficient coefficient times a frame quality constant divided by a frame complexity .

13. The method of Claim 10, wherein the calculating the frame quantization parameter based on the current frame bit rate comprises:

- calculating a bit budget for the current frame using the current frame bit rate;

- calculating an average macroblock quantization factor of a previous frame, wherein the previous frame and the current frame have a same frame type;

- calculating the frame quantization parameter using the bit budget; the average macroblock quantization factor of the previous frame, and a bit usage of the previous frame.

14. The method of Claim 13, wherein the frame quantization parameter is equal to one fourth of the average macroblock quantization factor multiplied by the sum of three plus the bit usage divided by the bit budget.

15. The method of Claim 1, further comprising calculating an underflow quantization parameter for each macroblock of the current frame.

16. The method of Claim 15, wherein the comprising calculating an underflow quantization parameter for each macroblock of the current frame comprises

- calculating a maximum macroblock bit budget;

tracking a total bit usage for the current frame;
tracking a count of a number of processed macroblocks;
calculating the underflow quantization parameter using
the maximum macroblock bit budget, the total bit usage, and
the count.

17. The method of Claim 16, wherein a new value of the underflow quantization parameter is equal to a current value of underflow quantization parameter multiplied by one plus the total bit usage minus a product of the count and the maximum macroblock bit budget divided by the maximum macroblock bit budget

18. The method of Claim 15 further comprising applying activity masking to generate a macroblock quantization parameter using the underflow quantization parameter.

19. A method of creating macroblock quantization parameters for a current frame using a frame quantization parameter, the method comprising:

setting an initial value of the macroblock quantization value to be equal to the frame quantization parameter;
calculating a maximum macroblock bit budget;
tracking a total bit usage for the current frame;
tracking a count of a number of processed macroblocks;
calculating the underflow quantization parameter using
the maximum macroblock bit budget, the total bit usage, and
the count.

20. The method of Claim 19, wherein a new value of the underflow quantization parameter is equal to a current value of underflow quantization parameter multiplied by one plus the total

bit usage minus a product of the count and the maximum macroblock bit budget divided by the maximum macroblock bit budget.

21. The method of Claim 19 further comprising applying activity masking to each macroblock.

22. The method of Claim 19, further comprising calculating the frame quantization parameter.

23. The method of Claim 22, wherein the calculating the frame quantization parameter comprises:

- calculating a complexity ratio;
- calculating a current frame bit rate using the complexity ratio factor; and
- calculating the frame quantization parameter based on the current frame bit rate.

24. A frame quantization parameter calculation unit for calculating a frame quantization parameter for a current frame of a video stream comprising:

- frame complexity calculation unit configured to calculate a complexity ratio;
- a current frame bit rate calculation unit coupled to receive the complexity ratio and configured to generate a current frame bit rate; and
- a current frame MQANT calculation unit coupled to receive the current frame bit rate and configured to generate the frame quantization parameter.

25. The frame quantization parameter calculation unit of Claim 24, further comprising a bit balance adjustment unit

coupled to the current frame bit rate calculation unit and configured to generate a bit balance adjustment factor.

26. The frame quantization parameter calculation unit of Claim 24, further comprising a frame coding efficiency calculation unit coupled to the current frame MQQUANT calculation unit and configured to generate a frame coding efficiency factor.

27. The frame quantization parameter calculation unit of Claim 24, wherein the complexity ratio is equal to a local complexity divided by a global complexity.

28. A system for generating a frame quantization parameter for encoding a current frame of an incoming video stream having a plurality of frames, the system comprising:

- means for calculating a complexity ratio;
- means for calculating a current frame bit rate using the complexity ratio factor;
- means for calculating the frame quantization parameter based on the current frame bit rate.

29. The system of Claim 28, wherein the means for calculating a complexity ratio comprises:

- means for calculating a local complexity;
- means for calculating a global complexity; and
- means for setting the complexity ratio to equal the local complexity divided by the global complexity.

30. The method of Claim 28, wherein the means for calculating a local complexity comprises:

- means for calculating a new average local complexity;

means for calculating a new value for the local complexity as a weighted average of a current value of the local complexity and the new average local complexity.

31. The system of Claim 28, further comprising means for calculating a bit balance adjustment factor that is used by the means for calculating a current frame bit rate using the complexity ratio factor.

32. The system of Claim 31, wherein the means for calculating a bit balance adjustment factor comprises:

means for tracking a bit balance of a plurality of previously processed frames;

means for dividing the bit balance by a duration to generate the bit balance adjustment factor.

33. The system of Claim 28, further means for comprising calculating a frame coding efficiency factor.

34. The system of Claim 33, wherein the means for calculating the frame quantization parameter based on the current frame bit rate comprises:

means for calculating a bit budget for the current frame using the current frame bit rate;

means for calculating an average macroblock quantization factor of a previous frame, wherein the previous frame and the current frame have a same frame type;

means for calculating the frame quantization parameter using the bit budget; the average macroblock quantization factor of the previous frame, and a bit usage of the previous frame.

35. The system of Claim 28, further comprising means for calculating an underflow quantization parameter for each macroblock of the current frame.

36. A system for creating macroblock quantization parameters for a current frame using a frame quantization parameter, the system comprising:

- means for setting an initial value of the macroblock quantization value to be equal to the frame quantization parameter;

- means for calculating a maximum macroblock bit budget;

- means for tracking a total bit usage for the current frame;

- means for tracking a count of a number of processed macroblocks;

- means for calculating the underflow quantization parameter using the maximum macroblock bit budget, the total bit usage, and the count.

37. The system of Claim 36, wherein a new value of the underflow quantization parameter is equal to a current value of underflow quantization parameter multiplied by one plus the total bit usage minus a product of the count and the maximum macroblock bit budget divided by the maximum macroblock bit budget.

38. The method of Claim 36 further comprising means for applying activity masking to each macroblock.

39. The system of Claim 36, further comprising means for calculating the frame quantization parameter.

40. The system of Claim 39, wherein the means for calculating the frame quantization parameter comprises:

means for calculating a complexity ratio;

means for calculating a current frame bit rate using the complexity ratio factor; and

means for calculating the frame quantization parameter based on the current frame bit rate.